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FARMERS' BULLETIN No. 1538

INCUBATION  
AND BROODING  
OF CHICKENS



The reproduction of the flock from year to year is one of the poultry raiser's most important problems.

To insure best success in incubation and brooding, the hatching eggs must have come from breeding stock of the highest possible quality and free from disease.

The use of the incubator and the brooder is recommended as the most economical and labor-saving way of reproducing the flock.

The best conditions of incubation are provided by proper temperature and ventilation and an adequate supply of moisture.

The most favorable conditions of brooding are provided by proper temperature according to the age of the chicks and climatic conditions, plenty of room, not more than about 350 chicks in one brooder house, good ventilation, and clean houses and soil.

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# INCUBATION AND BROODING OF CHICKENS

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## REPLACING THE FLOCK

The importance of adopting the most efficient methods of incubation and brooding can be appreciated when it is realized that at least 150,000,000 laying pullets have to be raised in the United States every year to replace that number of yearling and older hens. The number of laying hens kept on the farms of the United States annually is estimated to be at least 400,000,000, of which more than one-third are culled at the end of the laying year, in addition to which a small percentage die. Under average conditions hens lay best during their first year of production, after which production decreases gradually each succeeding year. It is important, therefore, to cull the laying flocks closely at least once annually to remove those hens which will not produce profitably the following year and to replace them with the more profitable producing pullets.

The necessity of renewing more than one-third of the flock each year is one of the most important problems in poultry raising. It is one of the most important causes of failure on the part of many beginners. Furthermore, methods of incubation and brooding determine to a considerable extent the profits to be made out of the laying pullets raised. A poor hatch represents an economic loss which can not be compensated for, and the chicks that do hatch are apt to be of inferior quality. A high mortality among chicks represents an economic loss; the higher the mortality the more certain that the breeding stock was of inferior quality, was diseased, or that methods of brooding were inefficient.

Possibly the best measure of one's ability as a poultry raiser is the number of fully matured chickens raised in proportion to the number of eggs set.

## INCUBATION

The fundamental object of incubation is to obtain the largest possible number of good chicks in proportion to the number of eggs set. The problem of incubation, therefore, is an important one, because inefficient management during incubation spoils hatching eggs of good quality which would normally hatch into good, strong chicks. Whether hens or incubators should be used for incubation depends largely on local circumstances, but if early chicks or large numbers of chicks are required, then the incubator becomes a necessity. There are many sections of the country where the use of an incubator and coal-burning brooder would enable the farmer to hatch and rear chicks in time to have them develop into October and November layers.

Another outstanding advantage of the incubator over the broody hen is that chicks can be hatched in larger units, thus putting the cost of hatching on a more economical basis. Many of the flocks of the country are composed of Leghorns, a nonsitting breed, so that incubators have to be used. In other breeds that are bred for egg production, such as the Plymouth Rocks, Rhode Island Reds, and Wyandottes, broody hens are sometimes scarce, and in many flocks few broody hens appear before the breeding season is well advanced.

When incubators are used for hatching there is less danger of the chicks becoming infected with lice and other parasites.

Taking all things into consideration, it is evident that under average conditions hatching chicks with incubators is not only more satisfactory but also more economical, particularly where large numbers of chicks are hatched. Besides, the incubator has the distinct advantage of hatching a few or several hundred chicks at one time, and with the use of the coal-burning brooder stove the problem of reproducing the flocks from year to year is materially simplified.

## TIME TO HATCH

It is very important that chicks be hatched early, because the profits in poultry raising depend, to a considerable extent, on fall and early winter egg production. The larger part of poultry receipts is obtained from eggs. This is true in the case of both farm-poultry raising and commercial poultry plants. Farmers and commercial poultrymen should realize, therefore, that one of the most important things to consider is getting good egg production the year round.

It should be borne in mind that the price of eggs is highest from about the middle of August to the middle of January. The department has kept a record of average monthly farm prices of eggs from 1910 to 1924 and finds that the price is lowest in the month of April, remains fairly steady until July, and then begins to increase until December, although through January the price still remains at a fairly good figure. From August to January, therefore, is the season of highest prices, and if egg production is good during that period profits in egg production are increased greatly. Unfortunately, however, on most farms and on many commercial poultry plants, it is during the fall and early winter months that the old hens are in the process of molting and pullets have not yet commenced to lay. Thousands of farmers lose large sums of money simply because they do not

hatch their pullets early enough to begin laying in time for the high prices during the fall and early winter months. They fail to realize that pullets are almost the only source of eggs at that time of the year, because hens are sure to molt, and they may take from 30 to 90 days to go through the complete molt.

Poultry producers can not control prices except possibly indirectly, but they can control production to a considerable extent. This can be done by hatching pullets at the proper time of the year so that they will be in good laying condition by the middle of October or the fore part of November at the very latest. There are several distinct advantages in hatching pullets early. In the first place, the earlier they are hatched the earlier they commence to lay and, moreover, it has been demonstrated that early maturing birds usually make the best annual layers. They should not be made to lay too early, however; otherwise the size of the first eggs laid is apt to be excessively small, and the pullets may go into a partial or complete body molt after laying a few eggs.

Leghorn pullets and pullets of similar breeds should come into laying when about 6 months old, and the heavier breeds, such as Plymouth Rocks, Rhode Island Reds, and Wyandottes, should begin laying when about 7 months old. Therefore, in order to take advantage of the high egg prices during the fall and winter months, pullets should be hatched about six months prior to the middle of October, in the case of Leghorns, and about seven months prior to the middle of October, in the case of the heavier breeds. In the southern sections of the country the growing season is much longer than in the northern sections, and it has been found that chicks hatched after the middle of April in the South frequently do not do well. In the South, therefore, Leghorn chicks should be hatched by the first of April and those of the heavier breeds by the middle of April, while in the North, Leghorn pullets may be hatched up to the fore part of May, and those of the heavier breeds may be hatched up to the middle of April.

These dates, of course, are only approximate; the important thing is that farmers should hatch their chicks early if the highest profits are to be made in egg production the following year. It has been demonstrated repeatedly that late-hatched chicks do not do so well as early hatched ones.

There are advantages from hatching early other than those given above. In the case of early hatched chicks the males may be sold as broilers early in the season, when prices are usually highest. For instance, when chicks are hatched about the middle of April the males may be separated about the middle of July and sold as broilers when the price is usually very good, owing to the fact that other kinds of fresh poultry meat are scarce. Still another advantage of hatching chicks early is that early fryers are for sale before the great bulk of the poultry goes on to the market in the fall, and also one may have well-matured roasters ready for the Thanksgiving market.

One of the greatest troubles with the marketing of poultry in the United States is the excessive number of immature, scrawny chickens sent to market. Early hatching will do a great deal to counteract this condition because the cockerels will have a longer season in which to build a proper frame and then will have some time to put

on a finish. In view of these many advantages, farmers and commercial poultrymen should do everything possible to avoid late hatching, which is rarely as profitable as early hatching.

#### SANITATION IN INCUBATION

The importance of proper sanitation in incubation can not be over-emphasized, because lack of sanitation may be the cause of poor hatches and high mortality in the chicks. The hatching eggs should come from healthy breeding stock kept in strictly sanitary quarters. The eggs should be clean, because dirt on the shells may harbor disease organisms. Sitting hens should be treated with sodium fluoride to rid them of lice, and the nests should be kept clean and free from lice and mites. The incubators should be cleaned and thoroughly disinfected to destroy disease organisms before eggs are placed in them. Be sure that all down and dirt have been removed from the incubator, and disinfect the interior of the machine as well as the egg trays and nursery drawers with an efficient disinfectant, such as a saponified cresol solution.

#### SELECTING HATCHING EGGS

The careful selection of eggs for hatching purposes is a very important matter because the kind of egg incubated determines, to a large extent, the quality of chicks hatched. Fertile eggs of good hatching quality are necessary for good hatches. The male breeders should be placed with the female breeders about one month before eggs for hatching are to be saved. In cold weather the eggs should be gathered frequently to prevent them from becoming excessively chilled. All eggs for hatching should be uniform in shape and size, and sound in shell.

The size of the eggs used for hatching is very important because there is a high correlation between the size of eggs used and the size of chicks hatched. Furthermore, the continued use of small eggs for hatching purposes would soon result in depletion of constitutional vigor of the laying or breeding stock, as well as decrease in the size of eggs shipped to market. The most careful attention therefore should be given to the selection of the eggs for hatching purposes on the basis of size, and it is desirable to use no eggs weighing less than 2 ounces for incubation.

In the case of varieties of chickens that lay white-shelled eggs, all eggs used for incubation should be free from tints. This is an economic factor which has caused trouble in some strains of White Leghorns. In shipping eggs to market there is a tendency for the trade to discriminate against white eggs with tinted ones mixed in with them.

All eggs should be tested for cracked shells. This can be done quite readily by tapping two eggs together. If there is a resonant sound, both eggs are sound in shell; but if there is a dull sound, one of the eggs is cracked and should not be used for incubation.

Eggs for incubating should not be washed because washing opens the pores and makes possible excessive evaporation of the watery content during incubation. If dirt is observed on the shell, scrape

it off with a knife, or reject the egg. The more careful the selection of eggs for hatching purposes, the better the results.

Only fresh eggs should be set. Eggs deteriorate rather quickly after they are about 5 days old, while eggs 3 or more weeks old usually do not hatch at all. If the incubator capacity is relatively large, and a large number of eggs have to be saved before setting time, they should be kept in a cool room free from drafts and dust. It is not necessary to turn the eggs unless they are held more than five days, after which they should be turned daily; but under no

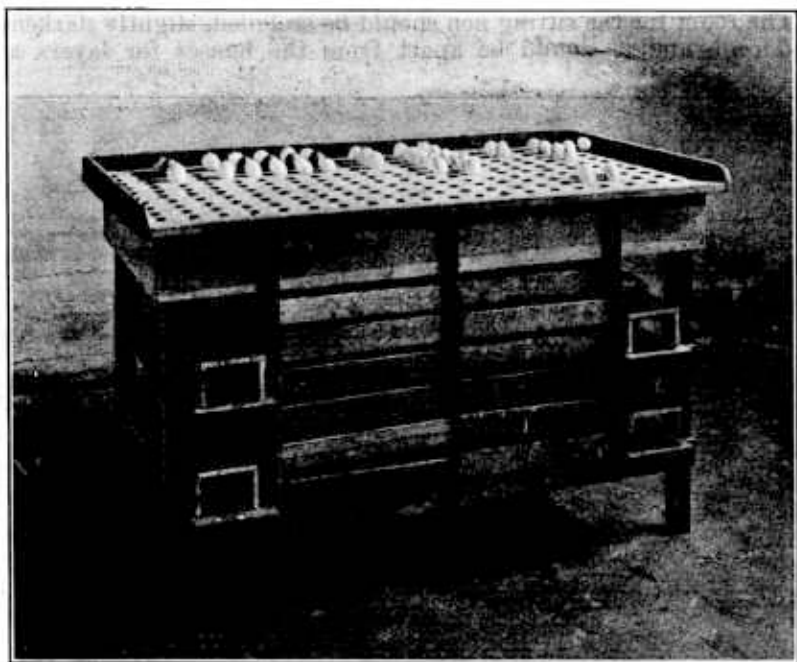


FIG. 1.—A convenient cabinet for holding hatching eggs until placed in the incubator. The top of the cabinet has indentations so that eggs may be arranged according to the hen or the pen they came from. The two rows of drawers are for holding the eggs from different pens

circumstances should eggs be saved for incubation longer than 10 days. The simplest way to hold hatching eggs is to keep them in baskets or egg trays, or they may be kept in cabinet drawers and turned by hand. (Fig. 1.)

#### HATCHING WITH HENS

To raise chicks with hens it is necessary to have good brooding hens, properly constructed nests, and to give careful attention during the incubation period.

The hen selected should have the broody instinct well developed. She should be of medium size and large enough to cover well the required number of eggs. The number of eggs in a setting varies from 11 to 15, the smaller number in the early part of the season, when the weather is cold, and 15 later, when the weather is warmer.



Breeds of the general-purpose type, such as Plymouth Rocks, Rhode Island Reds, and Wyandottes are among the best sitters. The lighter breeds, such as Leghorns, are called nonsitters and generally can not be relied on to hatch a setting of eggs.

The nest should be built carefully with fine, soft hay, straw, or leaves. It should be of such size and shape that the hen will fill it nicely, affording complete protection for a single layer of eggs. If the nest is deep the eggs may pile up and break. The nest should be placed in such a position that the hen will not have to fly or jump into it.

The room for the sitting hen should be secluded, slightly darkened, and cool, and it should be apart from the houses for layers and



FIG 2.—A very simple arrangement of nests for sitting hens. The door in front is shown open, but can be closed to keep hens on the nests

breeders. It will be found convenient and satisfactory to set a number of hens so that each will be confined to her own nest. (Fig. 2.) At feeding time they can be allowed to feed together, but each hen should return to her own nest and the door of the nest closed. Place a dust box in the room so that the hens can dust themselves.

The best time to set a hen is after dark. Have the nest carefully prepared and, if convenient, place 2 or 3 infertile or artificial eggs in the nest and do not disturb her the first day. When she is sitting well the eggs may be placed under her.

At the time of sitting it is very necessary to dust the hen thoroughly with sodium fluoride. Some hens may become so badly infested with lice that they will leave their nests. To disinfect the hen, take her

by the feet, holding her head downward, and rub pinches of sodium fluoride well into her feathers, especially around the vent.

The nest should be examined frequently to be sure that no eggs have been broken, or in case any have been broken the shells and soiled nesting material should be removed and the rest of the eggs should be washed with warm water to remove any material that came from the broken eggs.

The feed for the sitters should consist of hard grains, such as wheat, oats, corn, or a mixture of these. If the hens are confined, green feed should be given occasionally. Grit and clean water should be kept before them always.

At hatching time do not disturb the hen. Let her sit quietly after the nineteenth day but watch her closely to see that she does not leave the nest with the first chick she hatches. She should be allowed to remain on the nest a few hours after all the chicks are hatched.

#### HATCHING WITH INCUBATORS

Artificial incubation is used extensively all over the country by all kinds of poultry raisers. It is the most practicable method for commercial poultry farms. It also has its place on the farm and in the back yard where poultry is a side issue. During recent years many hatcheries have been developed where the hatching and sale of baby chicks is the sole business and where millions of chicks are hatched each year.

#### TYPES OF INCUBATORS

There are on the market many makes of incubators which are being used successfully in various parts of the United States. These incubators may be divided into two general groups, namely, small machines holding from 60 to 400 eggs, usually heated with kerosene lamps or with electricity, and mammoth incubators, made in two designs, those of cabinet design and those built in sections, the sections usually being in two or three tiers. Mammoth incubators may hold from about 2,000 to 40,000 or more eggs.

The small lamp machines are of two general types, hot air and hot water. Both styles are used successfully in all parts of the country, and there does not seem to be much difference in their comparative value. The hot-water incubator will hold its heat longer than the hot-air make in case the lamp should go out, but when the incubator receives proper attention the possibility of such an accident is too slight to be worth considering.

The use of electricity in incubating with small machines is increasing, although in many sections of the country hatching with electricity would be more expensive than hatching with kerosene. Electric incubators, however, require less work than others, but before purchasing one be very sure to make inquiries concerning voltage and other matters of importance.

Most of the mammoth incubators are heated by coal stoves, the incubators being equipped with hot-water heating pipes, but lamps are also used for some makes. Gas is used successfully for both small and large incubators, and in many sections, where the price

warrants, mammoth machines are operated electrically. Mammoth incubators of cabinet design are usually equipped with electrically driven fans to provide ventilation.

#### THERMOMETERS

There are two styles of incubator thermometers, with various modifications. One is placed on the egg tray, whereas the other is hung over the eggs so that the bulb just clears the top of them.

The position of the thermometer in the egg chamber has a relation to the proper temperature at which to operate the machine, as a difference of an inch in height in some egg chambers means at least a degree of difference in temperature. The thermometer is usually placed about 8 inches from the front of the egg tray so as to be easily read.

It is advisable to test the thermometers once a year with a clinical thermometer, which may be procured from a physician or at a drug store. This can be done by putting both thermometers in warm water, heated to about 103° F., taking care to keep the bulbs near each other and at the same level in the water. If the incubator thermometer is correct it will register the same as the clinical thermometer.

#### SELECTING AN INCUBATOR

Cheap incubators are usually less reliable, require more attention, and wear out much sooner than higher-priced ones. As the value of the machine is small compared with the value of the eggs used during the normal life of an incubator, it is poor economy to purchase an unreliable machine. Whenever possible it is well to select one of a make which is giving satisfaction in your vicinity, so that you may get the benefit of the experience of other operators.

The best-sized incubator to buy depends on circumstances. It takes about as much time to care for a 60-egg machine as for one with a capacity of 360 eggs; it is generally advisable to get one of at least 150-egg capacity, although special conditions may make smaller machines desirable. Incubators of from 300 to 400 egg capacity are generally used on those large farms which use individual lamp incubators, but practically all large poultry farms, when installing new machines, now purchase the larger or mammoth incubators. Many poultrymen believe that it pays to have an incubator capacity large enough to hatch the bulk of their stock in two hatches, so that much time is saved in looking after the incubators and brooders and the chickens are more even in size than those hatched when the incubating period extends over a longer time.

The hatching capacity required for the reproduction of the flock from year to year depends on the size of the flock to be reproduced as well as on the number of chickens required to be hatched at one time. In the case of the 200-bird flock, 50 of which are yearlings for breeding purposes and the remaining 150 are pullets, at least 175 pullets should be raised to maturity to allow the culling out of 25 of the poorer pullets. To have 175 pullets in the fall would mean that a flock of 350 chicks would have to be raised, because practically half the flock would be male birds. If allowance is made for about 15

per cent mortality during the rearing season, 350 chicks in the fall of the year would mean that approximately 420 chicks would have to be hatched. If the chicks are hatched in two successive hatches, 420 chicks would require 210 chicks for each hatch, or about 350 eggs would have to be set each time, which would allow for a 60 per cent hatch giving 210 chicks. For the two hatches, therefore, about 700 eggs would have to be set.

#### THE INCUBATOR ROOM

Incubators are successfully operated in a great variety of places. If only a few small machines are used they are generally kept in the cellar or in a room of the house. A well-ventilated cellar is usually much better than a room, because the temperature is subject to less variation and the air usually contains more humidity. A special cellar or incubator house should be provided when the incubator equipment is extensive or when mammoth machines are used. The main essentials are a room which is not subject to great variations in temperature, which is well ventilated, and which is not too dry. A furnace used in a house cellar makes the place too dry for the best results. Good results in hatching are obtained in incubator rooms which are entirely above the ground level, but in such cases the walls of the room should be double and the entire building well insulated. In mild climates incubators may be operated in buildings with single walls, but a well-insulated room is preferable.

The incubator room should be large enough to allow the attendant to work around the machines conveniently. The ideal room should be from 8 to 9 feet high; it should have a temperature of from 50° to 60° F., with a relative humidity of not less than about 70, which may be determined by hydrometer. The shape and size of the room should be governed by the size of the incubators to be installed. Manufacturers of the various mammoth incubators furnish room plans for use with their respective machines. Many incubator rooms are provided with some system of ventilation in addition to the windows, while in others the ventilation is controlled entirely by the windows. The essential features are to keep the air in the room fresh and sweet. Muslin screens or shutters on the windows provide good ventilation without direct drafts and at the same time keep the sun from shining on the machines. Many incubator rooms have cement floors, which are easier to keep clean than dirt floors.

#### SETTING THE INCUBATOR UP

Set up the incubator according to the manufacturer's directions, and see that the machine is perfectly level. If a spirit level is not available, a long, shallow pan of water set on top of the incubator can be used as a level. Be sure that all parts of the incubator are in their proper positions and that the regulator works freely. If the door of the incubator sticks, do not plane it off until the machine has been heated up and thoroughly dried.

Most operators attend to their incubators two or three times daily and occasionally make extra trips, as conditions require. Incubators require careful and regular attention, and neglect generally affects the hatch.

## REGULATING THE TEMPERATURE

Incubator manufacturers supply regulations for the operation of their incubators, and these should be followed closely until experience enables the operator to determine any minor variations that may be desirable. The forced-draft type of mammoth incubator requires a lower temperature than small incubators or mammoth incubators of the section type.

The following suggestions, in addition to the information given in the manufacturer's directions, may be useful to those operating machines of the lamp type: Run the machine at about 102° F. for at least two days before putting the eggs in. It takes several hours for the machine to come back to its correct temperature after the eggs are put in; therefore the regulator should not be touched during that time. See to the regulation of the temperature of the incubator before opening the door of the machine to attend to the eggs. The temperature of the egg chamber may be regulated by lowering the flame of the lamp in the middle of the day if the room is subject to a considerable rise in temperature at that time. The machine should receive care enough to keep the temperature nearly even.

The correct temperature depends on the position of the thermometer in the egg chamber. The manufacturer's directions should be followed without change unless considerable experience has indicated that they can be improved upon. The possible need of such change is due to the fact that no manufacturer can make a machine and rules to suit all conditions. When the bulb of the thermometer rests directly on the eggs, the temperature should usually be held at 101½° to 102° F. the first week, at 102° to 103° the second week, and at 103° the third week. A hanging thermometer calls for a temperature of about 102° to 102½° F. the first two weeks and 103° F. the last week. It is advisable to keep a daily record of the temperature of each incubator. At hatching time allow the temperature to go up to 103½° or 104°. In a good hatch the chicks in the eggs begin to pip on the evening of the nineteenth day, and most of the chicks will be out of the shell by the morning of the twenty-first day. If the hatch is much earlier or much later it indicates that conditions during incubation have not been right.

## CARE OF THE LAMP

Use good oil. Clean and fill the lamp once daily, trimming the wick by scraping the charred portion off with a knife or by cutting the wick with scissors. The burners should be kept free from dirt and thoroughly cleaned by boiling after each hatch. A new wick for each hatch is a good investment, thus eliminating any danger of the wick becoming too short. Turn the eggs before caring for the lamp so that there will be no chance of getting oil on the eggs. The flame is apt to increase in size after the lamp is lighted; therefore, it is advisable to return, a few minutes after lighting the lamp, to see that the flame is all right.

## TURNING AND COOLING THE EGGS

Eggs should be turned at least twice daily from the second until the eighteenth day, after which the chicks are due to pip. In large

incubators various mechanical devices are used for turning the eggs, but most poultrymen using small machines prefer to shuffle the eggs with their hands, removing a few from the center of the tray and working the others toward that point, placing on the sides of the tray those taken out. When mechanical devices are used to turn the eggs so that very little time is consumed, it is usually advisable to turn the eggs 3 or 4 times a day. In lamp machines, after turning the eggs, reverse the egg trays end for end and from one side of the machine to the other in 2-tray incubators. It is usually advisable to keep the incubator door closed while turning the eggs. Be very careful to turn the eggs gently, to avoid cracking or jarring them, as rough handling may prevent the embryo from developing. Cracked eggs may be saved by putting court-plaster over the crack, but it is advisable only when the eggs are very valuable.

For many years it was common practice to cool the hatching eggs every day by taking them out of the incubator and leaving them out until they felt cool to the touch. More recently, however, this practice has been discarded generally and seems to be necessary only when the temperature of the incubator has been running a little high. In order to determine whether to cool the eggs or not, the operator should be guided by the size of the air cell, which should increase gradually in size; this indicates a gradual development of the embryo. (Fig. 3.) If the development is too rapid, cool the eggs until they feel slightly cool to the hand, face, or eyelids. To cool the eggs, remove the trays and place them on top of the machine or on a table so that they are not in a draft and so that the tray does not project over the edge of its support and thereby allow part of the eggs to cool much more quickly than the rest.

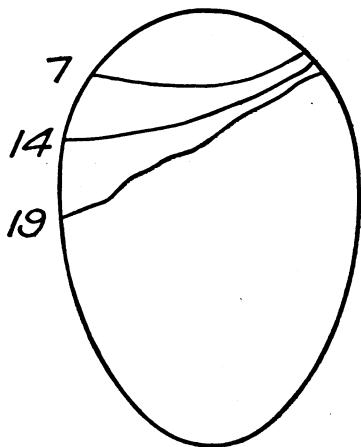


FIG. 3.—Diagram showing the air cell on the seventh, fourteenth, and nineteenth days of incubation

#### MOISTURE SUPPLY

Too much moisture in the egg chamber may prevent the normal evaporation necessary to allow space enough for the chick to turn in the egg and break the shell, while too little moisture may cause the chick to become dried and stick to the shell. Moisture is used extensively in hatching in the South, in high altitudes, and in places where the incubator is run in a dry room.

In order to supply moisture in incubators, many methods are used, such as sprinkling the eggs with warm water, or placing a pan of water or moist sand in the incubator below the egg tray. Another common method of supplying moisture is to sprinkle or soak the floor of the incubator room.

The question of moisture depends largely on the place where the incubator is operated. If in a room in a dwelling house, it is frequently necessary to add moisture, while the same machines operated in the cellar of the same building may not need any extra moisture. When several lamp machines are operated in one room extra moisture is more necessary than if there is only one in the room. More moisture must be supplied in a very dry than in a humid climate. As the weather becomes warmer, more moisture is generally used than earlier in the season.

Figure 3 shows the comparative size of the air cell in an egg on the seventh, fourteenth, and nineteenth days of incubation. The size of this air cell varies with the size of the egg, and the shape varies greatly in different eggs. If the air cell is too slow in enlarging, too much moisture has been supplied, whereas too large an air cell indicates that more moisture should be given and that the eggs should be cooled less. Moisture on the glass door of the incubator during hatching time is the best indication of correct moisture conditions during incubation.

#### TESTING THE EGGS

All eggs should be tested at least twice during the period of incubation, preferably on the seventh and fourteenth days, all infertile eggs and those with dead embryos being removed at the first test, and embryos dying after the first test being removed at the second test. White eggs can be tested on the fourth or fifth day, but the development in brown-shelled eggs can not be seen by the use of an ordinary egg tester until the seventh day. Eggs with dead germs soon decay and give off a bad odor if allowed to remain in an incubator. Many operators of mammoth incubators make one test about the fourteenth day, removing all infertile eggs and dead embryos at that time.

A good homemade egg tester or candler can be made of a box which, set on end, is large enough to inclose the light or lamp. A hole slightly smaller than an egg should be cut in the side of the box at the same level as the light. An electric, gas, or kerosene lamp may be used. If a kerosene lamp or gas lamp is used, there should also be a good-sized hole at the top of the box; otherwise the heat from the top of the chimney may set the box on fire. Some incubator manufacturers furnish testing chimneys which fit the incubator lamps. (Fig. 4.)

The eggs are tested with the large end up, so that the size of the air cell as well as the condition of the embryo may be seen. The testing should be done in a dark room. The infertile egg when held before the candling device looks perfectly clear, as does a fresh egg. A fertile egg shows a small, dark spot, known as the embryo, with a mass of little blood vessels extending in all directions, if the embryo is living. If the embryo is dead and the egg has been incubated for at least 48 hours, the blood settles away from the embryo toward the edges of the yolk, forming in some cases an irregular circle of blood known as a "blood ring." Eggs vary in this respect, some showing only a streak of blood.

On the fourteenth day the eggs containing strong, living embryos are dark and well filled and show a clear, sharp, distinct line of

demarcation between the air cell and the growing embryo, whereas eggs with dead germs show only partial development and lack of this clear, distinct outline.

#### TAKING THE HATCH OFF

After the eighteenth day, unless it is necessary, do not open the incubator door until the hatching is well over. Do not open the incubator to see how the eggs are hatching, as this allows the moisture to escape, causing many of the chicks to become dry and to stick in the shells. Most machines are arranged with a movable wire piece in the front of the egg tray and this is opened when the hatch is

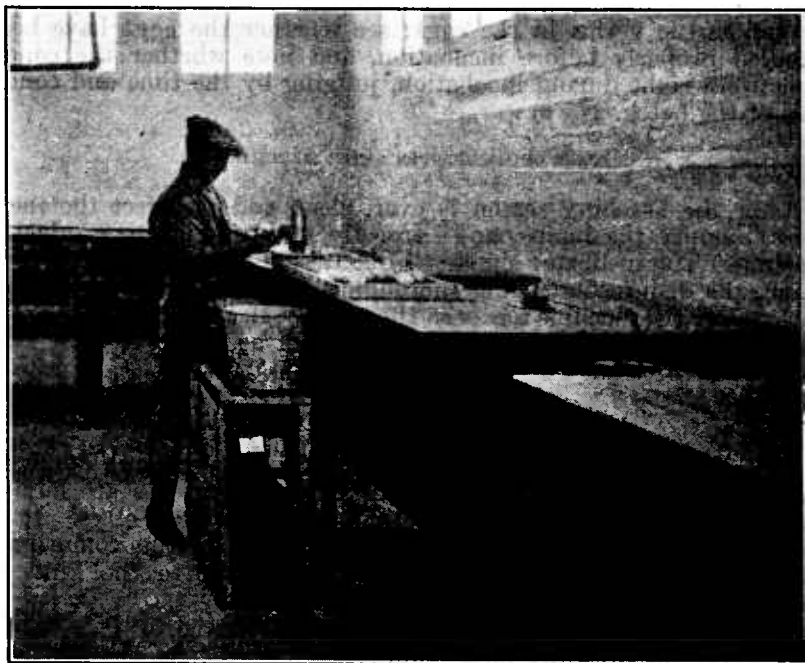


FIG. 4.—When a few hundred chicks are raised annually, the incubator is a good investment. This illustration shows the operation of testing eggs with a tester frequently supplied with the incubator

completed, so that the chicks can get down into the nursery tray after they are dried off.

Chicks which pip but are unable to get out of the shell by their own efforts rarely amount to much if helped out. If it seems desirable, however, when most of the eggs are hatched and the chicks have dried off so that they will not be injured by opening the incubator door, any which have pipped may be helped out by cracking the shell and placing them back on the egg tray.

As soon as the chicks are through hatching, remove the shells and eggs with dead embryos and place all the chicks in the nursery trays; then set the incubator door slightly ajar to allow ventilation so that the chicks will dry off and harden before being removed to the



brooder. Keep the temperature in the incubator, taken at a level of the chicks' heads, at about 95° F. for from 36 to 48 hours after the hatch is complete; then remove the chicks to a brooder in a covered box, being careful not to permit them to become chilled while being transferred.

#### PROBABLE CAUSES OF POOR HATCHES

The cause of poor hatches is a much-discussed question and depends on a great variety of circumstances. A poor hatch is more likely to be caused by the condition of the eggs before hatching than by faulty incubation, although improper attention to either factor produces the same results. When eggs fail to hatch, find out whether the breeding stock is kept under conditions which tend to produce strong, fertile germs in the eggs; see whether the eggs have been handled properly before incubation, and note whether the conditions were right during incubation, judging by the time and condition of the hatch.

#### CARE OF INCUBATORS AFTER HATCHING

After the hatching season is over, clean and disinfect the incubators, empty the lamps, and carefully store the parts inside the machine. The incubator should be disinfected thoroughly after each hatch, the disinfectant being thoroughly applied to all the interior parts, after the machine has been thoroughly cleaned and all the dirt and down have been removed. Care should be taken to make sure that the disinfectant used is an efficient one.

#### BUYING DAY-OLD CHICKS

Because of the very rapid development of the mammoth hatchery business in the United States, more and more farmers are buying day-old chicks instead of incubating the eggs themselves. It is very important that farmers who buy day-old chicks from commercial hatching establishments pay particular attention to the kind of hatchery from which they purchase their chicks.

Day-old chicks of the highest quality are produced in those hatcheries where the breeding flocks supplying the eggs for the hatchery are inspected carefully and culled rigidly and only the best birds in the flock are used as breeders. The poultry plants where the breeding flocks are maintained should be kept in sanitary condition at all times, and the eggs sent to the hatcheries should be of good size, as well as uniform in shape, shell color, and shell texture. Furthermore, the hatcheries where the incubation is carried out should be kept in strictly sanitary condition at all times, and the management of the incubator should be such as to produce the highest possible quality of chicks. Farmers are strongly advised to buy only good-quality chicks because cheap chicks are liable to be of poor quality and to give very unsatisfactory results.

#### BROODING

Given healthy and vigorous chicks as they come from the incubator, it is essential that the conditions of brooding should be such as to promote the most economical growth. The most important

factors in brooding, whether artificial or natural, are proper temperature, plenty of room, and sanitation. In natural brooding, however, a uniform temperature is supplied by the mother hen, and owing to the fact that a hen can accommodate only a limited number of chicks, there is little or no danger of overcrowding. At the same time, chicks in large numbers are being raised very successfully artificially, particularly since the introduction of brooder stoves. The use of brooder stoves reduces the cost of brooding and lessens labor; and their use should be of considerable value on most farms.

#### SANITATION IN BROODING

One of the most frequent causes of failure in brooding chicks is lack of proper sanitation. Brood coops, brooders, and brooder houses are frequently allowed to get very dirty, and sometimes are never disinfected, with the result that the chicks become infected with such diseases as coccidiosis and bacillary white diarrhea. The latter is a communicable disease, the organism being transmitted from generation to generation through the egg, and the only way to eradicate the disease is to remove all infected breeders; but thorough disinfection of brooding equipment and premises will do much to prevent the transmission of the disease from infected to noninfected chicks. All equipment used in brooding chicks, brood coops, and brooder houses should be disinfected before the brooding season begins and at frequent intervals thereafter. For that purpose saponified cresol solution is one of the best disinfectants.

The litter used in brooder houses should be cleaned out frequently, at least once a week during the first three or four weeks, the floors thoroughly disinfected, and clean litter supplied. This is very important because the floor soon becomes contaminated and disease is apt to spread from one chick to another.

A common cause of poor growth and high mortality in chicks is contaminated soil. Too frequently chicks are allowed to run with the adult birds on soil which is rarely cultivated or treated for parasites and disease organisms. The chicks should be brooded on land over which the old stock has never been allowed to range, in order to keep the chicks free from intestinal worms and various diseases. A good grass range is most desirable, and chicks should never be brooded on bare land. Do not overcrowd the chicks on the land, and do not use the fields for brooding one year that were used the year previous. The land immediately in front of the brooder house should be treated with lime or acid phosphate, cultivated, and sowed to a crop. The importance of keeping the soil in the brooder field sweet and clean can not be overemphasized.

#### BROODING CHICKENS WITH HENS

Hens should be fed as soon as possible after the chicks are hatched, as feeding tends to keep them quiet; otherwise many hens will leave the nest; at this time, however, do not allow the chicks to have any feed. When several hens have been set to come off at the same time, it may be advisable to give the chicks hatching first to one hen and distribute the unhatched eggs among the other hens. In most cases

it is best that the hen remain on the nest and brood the chickens for at least 24 hours after the hatching is over.

A hen will brood from 10 to 15 chickens successfully early in the season, and from 15 to 20 in warm weather, depending on her size. This method of handling chickens may be used where one has only a small number of chickens to raise; it is also a good method when it is desired to raise special lots of chicks separately. It should be borne in mind in giving chickens to a hen which already has some to brood, that it is best to add chicks of the same color and age as those already with her, as the hen will often pick the late arrivals if they are of a color different from those she is already brooding.



FIG. 5.—A boy poultryman spraying his brood coop to kill mites and disease germs.

This transferring should take place at night, although with a docile hen sometimes it can be done during the day.

Chickens hatched during the winter, when the weather is cold, should be brooded in a poultry house or shed; after the weather becomes more favorable they should be reared in brood coops out of doors. Brood coops should be made so that they can be closed at night to keep out cats, rats, and other animals, but there should be ventilation enough to give the hen and chicks plenty of fresh air. The construction of brood coops should be such as to permit them to be easily cleaned and sprayed. A good coop is illustrated in Figures 5 and 6. The floor dimensions of the brood coop are 20 by 30 inches; the height is 26½ inches in front and 18 inches in the rear. Plans of coops of other styles may be obtained by writing to the poultry department of your State agricultural college.

The hen should be confined in the coop or in a small yard attached to the coop until the chicks are weaned, the chicks being allowed

free range after they are a few days old. The use of a small, covered yard attached to the coop gives the hen more freedom and keeps her in better condition than if she is confined to a coop all the time. If a hen is allowed free range and has to forage for feed for herself and the chicks she often takes the chicks through wet grass where they may become chilled and die.

Even when confined, the chickens frequently have to be caught and put into their coops during sudden storms, as they are likely to huddle in some hole or corner where they get chilled or drowned. Chickens rarely recover entirely from the effects of checks even for short periods in their growth. Hens are usually left with their young chicks as long as they will brood them.



Fig. 6.—Hens confined to the brood coops. There is a wire door back of the boarded front of this coop which can be slid sidewise. This arrangement furnishes the hen and chicks plenty of ventilation and fresh air at night and prevents any animals from entering the coop

Brood coops should be moved weekly to fresh ground, preferably where there is new grass. Shade is very essential in rearing chickens, especially during warm weather. A cornfield makes fine range for young chickens, as they obtain many bugs and worms and have fresh ground to run on most of the time, inasmuch as the ground is kept cultivated, and at the same time they have abundant shade.

#### ARTIFICIAL BROODING

Brooders may be classified as follows, according to their capacity: Lamp brooders holding from 25 to 100 chicks; electric brooders of various sizes, accommodating from 50 to 500 chicks; stove brooders heated by coal, kerosene, or distillate oil, with a capacity varying from 200 to 1,000 chicks; and hot-water-pipe systems, the capacity of which is unlimited. The beginner, if possible, should thoroughly investigate the brooding equipment used successfully by poultrymen or farmers.

Lamp brooders are heated with either hot air or hot water, with kerosene oil as the source of heat. The danger from fire, caused by carelessness or lack of attention, is considerable in cheap brooders. There is some risk in the best grades, although proper care will reduce it to a minimum. When a lamp is used as the source of heat, care should be taken to keep the wick and burner properly cleaned. Brooder lamps and stoves should be inspected several times a day. Do not fill the brooder lamp entirely full of oil, as the heat from the lamp will expand the oil in the bowl and may cause it to overflow and catch fire.

Electric brooders are coming into greater use in many sections of the country where the cost of electric current is comparatively low. The current must be dependable at all times during the brooding

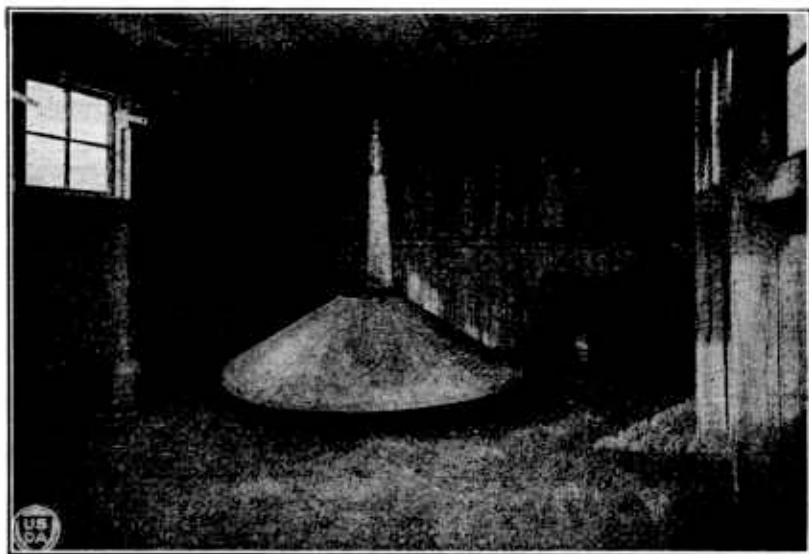


FIG. 7.—The interior of a colony brooder stove with coal stove brooder set up. Note particularly the pieces of wire tacked across the corners of the house to prevent the chicks from crowding into the corners

season because if it is off for a few hours the chicks may become chilled, and high mortality result. In many sections of the country, especially where chicks are brooded early in the season, it is necessary to heat the brooder room to a temperature of from 60° to 70° F. in order to maintain the proper temperature under the hover of an electric brooder.

Brooders heated by coal are coming into very general use in the East, while similar brooders heated with engine distillate oil are used extensively on the Pacific coast. These brooder stoves have a capacity of from 350 to 1,000 chicks each, but the brooding of not more than 350 chicks in one flock usually gives better results than when larger numbers are brooded together. Most of these stoves have hovers, although a few of the oil stoves do not. A stove with a

hover is preferable. (Fig. 7.) The use of hard coal of chestnut size is advised for the coal-burning brooder stoves, although in some sections where hard coal can not be obtained and soft coal is abundant the latter may be used, but in that case the brooder requires more frequent attention. Most of the oil brooders are equipped with a wafer regulator that controls the flow of oil, which is fed automatically from a tank or barrel outside the house. Several stoves may be connected with the same supply tank. This brooding system provides good ventilation and heat enough to keep the chickens from crowding and requires a minimum of care. Brooder stoves heated by kerosene are used somewhat in the East, but their use is not nearly so common as that of the coal-heated brooders, and they have not proved to be so satisfactory. In the colder parts of the country it is frequently difficult to get heat enough from kerosene-heated stoves when brooding chicks early in the season.

The system of hot-water-pipe brooders consists of long brooder houses heated with hot water, coal being used almost exclusively for fuel. Many of the latest of these mammoth brooders are giving good results, and the labor of brooding a large number of chickens is less than when small brooders are operated. These brooders are suitable for very large farms or where broilers are raised during the winter months. Plans and specifications for brooder houses for hot-water-pipe brooders may be obtained from the manufacturers. If winter chickens are being raised it is advisable to heat the brooder house by placing brooder pipes around the outside walls of the brooder house, keeping the temperature at from 60° to 70° F., regardless of the temperature of the hover. The need for this room heat depends largely on the brooding system and on weather conditions, but it is usually necessary in order to maintain the desired temperature under the hover.

#### SELECTING A BROODER

The selection of the brooder is a very important matter because the successful brooding of chicks is frequently a difficult problem. Cheap, unreliable brooders may easily ruin many broods of good chicks. A reliable make will more than repay the difference in cost between it and a poor one in the first brooding season through lessened mortality and better growth of the chicks. Above all, be sure that the brooder is made of good material and that the thermostat is well made. The latter is a particularly important feature, because a poorly made thermostat or one that gets out of order readily may allow the temperature to rise until the brood of chicks is ruined or the temperature may drop so low that the chicks get chilled and contract pneumonia or some other disease.

For the farmer who raises about 400 chicks annually two brooder stoves would be satisfactory, one for the first hatch and another for the second. For the farmer who raises about 800 chicks annually four brooder stoves would be sufficient. They are not expensive to operate and save much time in caring for the chicks. They are particularly serviceable to farmers who raise about 400 or more chicks annually.

## OPERATION OF THE BROODER

Chickens are usually left in the incubator from 24 to 36 hours after hatching, without feeding, before they are removed to the brooder, which should have been in operation three or four days at the proper temperature for receiving chickens. A beginner should try his brooding system carefully before he uses it. Early mortality in chicks is frequently a result of the chilling they receive while being taken from the incubator to the brooder and also the result of not having the brooder running properly when the chicks are first put under the hover. In cool or cold weather the chicks should be moved in a

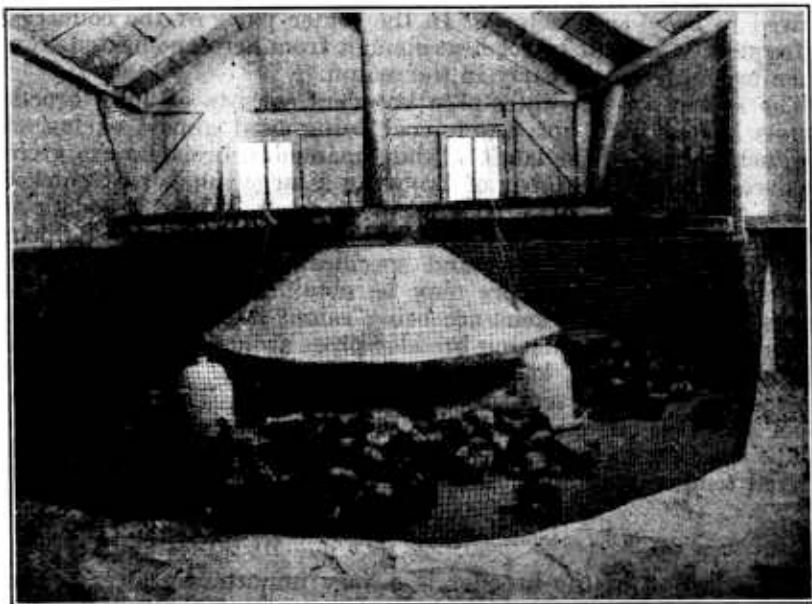


FIG. 8.—A coal-stove brooder with a brood of chicks. This type of brooder is well adapted for brooding chicks in flocks of from 150 to 500. Note particularly the wire fence, which prevents the chicks from going too far from the heat

covered basket or other receptacle, and the temperature under the hover should be about 95° F.

The floor of the brooder house should be covered with about 1 inch of cut clover, alfalfa, or straw. In case neither cut clover nor alfalfa can be obtained, sand may be used, although if the chicks are not fed properly they are inclined to eat the sand, and that sometimes causes loss. The litter should be removed frequently, as cleanliness is essential in raising chicks.

At first when chicks are put into the brooder they should be confined under or around the hover by placing a board or wire frame or guard a few inches outside. The fence or guard should be moved farther and farther from the hover and discarded entirely when the chicks are 3 or 4 days old or when they have learned to return to the source of heat. (Fig. 8.) The chicks should be watched closely to see that they do not huddle or get chilled. If they begin the bad

habit of toe picking, remove the wounded ones and paint their toes with tar. Getting the chicks outdoors will serve to check the habit.

The best temperature at which to keep a brooder depends on the position of the thermometer, the style of the hover, the age of the chicks, and the weather conditions. Aim to keep the chicks comfortable. When too cold they will crowd together and try to get nearer the heat. If it is found in the morning that the droppings are well scattered under the hover it is an indication that the chicks have had heat enough. If the chicks are comfortable at night they spread out under the hover of the brooder, and the heads of some protrude from under the hover cloth. Too much heat causes them to pant and gasp and sit with their mouths open.

It is impracticable to state the temperature at which brooders of each style should be kept. In most cases the brooder should be run at about 95° F., when the chicks are first put in, and the stove brooders should be kept at that temperature for the first few weeks, because the chicks are able to adjust themselves to the heat, moving nearer or farther from the heat, according to the outside temperature. The temperature is lowered, of course, as the spring season advances and as the chicks begin to feather out.

In brooders in which chicks do not have equal opportunity to adjust themselves to the heat the temperature is gradually reduced to 85° F. for the second 10 days, and then lowered to 70° or 75° F. and kept there as long as the chickens need heat. This depends somewhat on the season of the year and the number of the chickens, as it can be readily seen that the heat generated by 350 chickens would raise the temperature under the hover to a higher degree than the heat given off by a smaller number; consequently the heat furnished by the lamp or stove must be regulated accordingly. As the chickens grow larger and need less heat, the heat may be supplied only at night, and later only on cold nights. Care should be taken to prevent chilling or overheating the chickens, which weakens them and may result in bowel trouble. The heat is usually cut off after the chickens are well feathered. When the chickens are fairly well feathered, low roosts should be placed in the rear of the brooder house. The chicks will soon learn to roost, and this will prevent overcrowding on the floor. (See fig. 9.) Poultry raisers should bear in mind that chicks grow rapidly and frequently do not get ventilation enough if allowed to sit on the floor when a few weeks old.

Chicks need a cool place for scratching and exercising. The brooder stove is usually placed in the back part of the brooder house so that the front of the house will be cooler, or the brooder house may be divided into two sections, one in which the stove is placed, and one a cool room for exercising and feeding. This arrangement has the distinct advantage of allowing the chicks to get away from the heated section to scratch in the cool section, which tends to keep them in the best of health and growing well. The danger of keeping the chicks too warm, also a common mistake in single-room brooder houses, is avoided. The chicks should be allowed to run on the ground whenever the weather is favorable, provided the soil is not contaminated with worm eggs or disease germs. Be sure that the chicks can get in and out of the doorway readily; put a good mound of clean earth at the doorway. In many poultry plants



where trouble has been experienced with coccidiosis and intestinal worms, the chicks are confined to the brooder house or allowed only on small concrete yards for the first two or three weeks. Keeping the chicks on concrete yards for two or three weeks tends to control coccidiosis, bacillary white diarrhea, and worm infestation. For further information on diseases and parasites write for Farmers' Bulletin No. 1337, "Diseases of Poultry."<sup>1</sup> When the chicks are first allowed outside of the house they should be confined by a wire fence so that they can not get far away. The inclosure should be enlarged after a few days and then taken away altogether. (Fig. 10.)

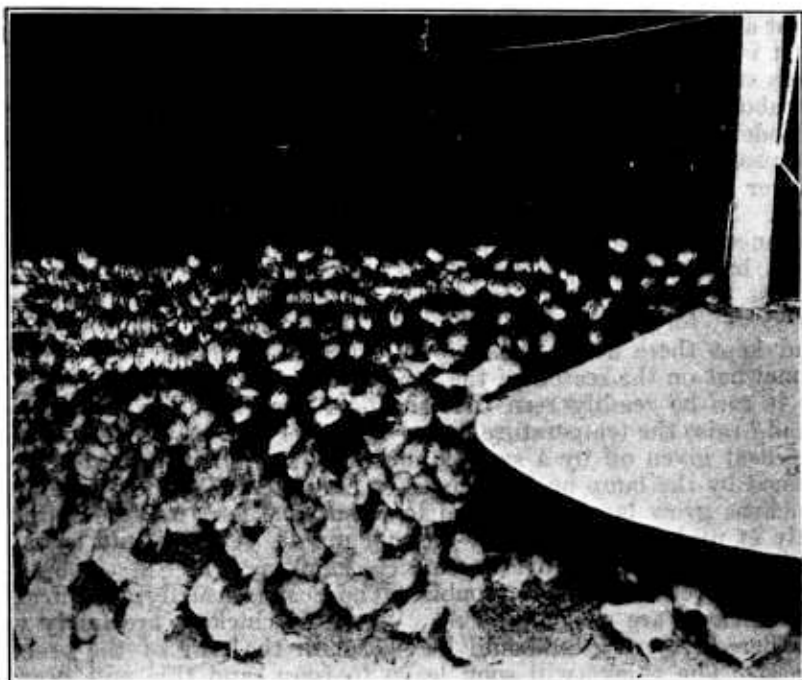


FIG. 9.—The low roosts enable the chicks to learn to roost early. This gives them better ventilation at night and they grow faster than when sitting on the floor

#### CARE OF BROODERS AFTER BROODING

When the chicks are old enough and when the weather is warm enough so that no more heat is required, the brooders should be removed from the houses, thoroughly cleaned, disinfected, and stored away for the next brooding season. Be sure that all parts of each brooder are stored away with the brooder and also be sure that the thermostats are in good condition so that there may be no delay when the brooder is to be used again.

#### BROODER HOUSES

The houses in which chicks are brooded and reared should be built so as to promote the best growth in the chicks. A brooder house should provide ample protection from the weather but should

<sup>1</sup>GALLAGHER, B. A. DISEASES OF POULTRY. U. S. Dept. Agr. Farmers' Bul. 1337, 41 p., illus. 1923.

also be well ventilated, because chicks do not do well if brooded in houses where the atmosphere is stuffy. At the same time there should never be a direct draft through the house. The main object should be to make the house as comfortable as possible under all circumstances. If boards or pieces of wire are put across the corners of the house the chicks will be prevented from crowding into the corners. This is important because many chicks are sometimes smothered as a result of piling up in the corners.

The brooder house should provide plenty of room for the chicks and allow at least 100 square feet of floor space for 300 chicks. At the same time, in most cases the house should be portable in order that it may be moved readily. Exceptions would be permanent houses where the hot-water-pipe brooders are used. Plans for such houses may be obtained from the brooder manufacturers. Portable houses for colony stove brooders may be built in different sizes and styles, but they should be of sufficient size and height to be convenient to



FIG. 10.—Shed-roof brooder house, 10 by 14 feet, with a capacity of 500 chicks. When the chicks are first allowed outdoors they should be confined in a small yard next to the brooder house. The yard should be enlarged after a few days and later the fence should be taken away.

work in while tending the brooder or feeding the chicks. The shed-roof brooder house illustrated in Figure 10 is used with satisfactory results at the U. S. Experiment Farm, Beltsville, Md. Plans of houses suited to conditions in any State may be obtained by writing to the poultry department of the State experiment station.

Brooder houses should be located on new ground every year. This can be done quite readily by setting aside two fields in which to rear the chicks, and using one field for chicks one year while the other field is growing a crop. Be sure, however, that the land used by the chicks has a good grass sod or is in clover or alfalfa. (Fig. 11.) Where there is a large orchard it may be divided into two parts, each part being used every other year. There should be plenty of shade where the chicks are being reared, and if shade trees are wanting, a growing crop, such as corn, provides plenty of shade, and the chicks have the advantage of roaming over soil that is cultivated frequently. At the same time the houses should be put where the chicks have ready access to an abundance of green feed. Many farmers and poultrymen

would find it distinctly to their advantage to set aside two fields of the farm for the exclusive purpose of rearing chicks alternately with raising a crop. By following such a system about 500 chicks could be raised on 2 acres, although if more land is available it would be advisable to use it. Above all, chicks should not be raised on the same land year after year, because soil contamination is one of the most important causes of failure in raising chicks. The ground on which chicks are reared should be cultivated, sowed to a crop, and not used for chicks for a year.

#### BROODING CHICKS IN CONFINEMENT

In some sections of the country, especially where commercial poultry raising is carried on extensively, chicks are brooded in confinement for the first few weeks. A number of years ago this practice was followed where broilers were being produced commercially, but was abandoned as a general practice because of trouble experi-



FIG. 11.—Brooder houses on good grass range where shade is abundant. Animal Husbandry Experiment Farm, Beltsville, Md.

enced in leg weakness in the chicks and because of heavy mortality frequently encountered.

More recently, however, the practice has been resumed as a result, largely, of the discovery that proper proportions of vitamin D in the ration prevent leg weakness. Another reason for the resumption of the practice was that when chicks were reared on the same ground year after year various troubles were frequently encountered, such as coccidiosis, intestinal roundworms, and tapeworm infestation. Poultry men found that soil which had been allowed to become contaminated with disease germs and infested with worm eggs was an unsafe place on which to attempt to raise chickens. Brooding chicks in confinement was adopted as an alternative to providing new range or cleaning up the old range.

One outstanding advantage in brooding chicks in confinement is the saving of labor, particularly in the case of large numbers of chicks. A hot-water-pipe brooder is generally used in a long brooder house, which is divided into a number of pens, each large

enough to accommodate from about 350 to about 1,000 chicks. Such an arrangement requires much less labor in tending the chicks than is the case when the chicks are brooded under the colony brooding system, with the colony houses 100 or more feet apart. This saving of labor is an important matter and so also are mortality and the rate of growth of the chicks.

#### NECESSARY PRECAUTIONS

Brooding chicks in confinement is an adequate precaution against intestinal-roundworm infestation and also serves to avoid losses from coccidiosis provided the organisms of that disease are not taken into the house in litter or on the feet. Should that happen, and coccidiosis gains an entrance into a long brooder house containing several thousand chicks, the losses may be heavy. Also, brooding chicks in confinement is not necessarily a safeguard against tapeworm infestation, but undoubtedly the amount of infestation is reduced materially.

Several other troubles are frequently encountered when chicks are brooded in confinement. Toe picking, tail picking, and body picking are three bad habits that sometimes develop. Toe picking is usually the first trouble to make its appearance and may develop when the chicks are but a few days old. Tail picking may develop shortly after feathers have replaced the down, and body picking sometimes occurs as an aftermath of tail picking. Many poultrymen who have experienced considerable losses from these three troubles are at a loss, for the most part, to ascribe any particular cause or to suggest a definite remedy. Any one of the three troubles may occur when good rations are being fed and when all conditions of brooder management are considered satisfactory.

Darkening the windows and painting the inside of the brooder house blue seems to be of some assistance in avoiding the troubles, particularly in the case of toe picking. Where tail picking and body picking develop, however, probably the wisest thing to do is to allow the chicks outdoors.

One thing is certain, when chicks are brooded in confinement the brooder house must be kept in a strictly sanitary condition at all times. The litter should be removed weekly and the house disinfected frequently.

Although brooding chicks in confinement saves labor, it also requires more careful management to avoid losses than when chicks are reared on range under the colony system, especially if new land is used each year. Not only do chicks brooded in confinement need more careful attention than chicks brooded on range, but there is also greater danger of overcrowding the houses, especially if the chicks are kept beyond the broiler stage.

For the production of broilers on a commercial scale brooding in confinement has been proved to be satisfactory, but where pullets are being raised for laying purposes it is undoubtedly advisable to give them range on clean soil.

#### PROBABLE CAUSES OF POOR RESULTS IN BROODING

If the results in brooding have been unsatisfactory, try to determine the cause at once. The sooner the cause is determined the sooner conditions may be improved.

Poor-quality chicks are frequently a cause of poor results in brooding. The chicks may have come from weak or diseased breeding stock. Adverse conditions of incubation may have affected the quality of the chicks. Methods of brooding may have been at fault. The temperature may have been uneven, causing the chicks to become chilled, giving rise to such conditions as brooder pneumonia or bowel trouble. Overcrowding is another common cause of failure in brooding. Lack of proper sanitation in the brooder houses and contami-

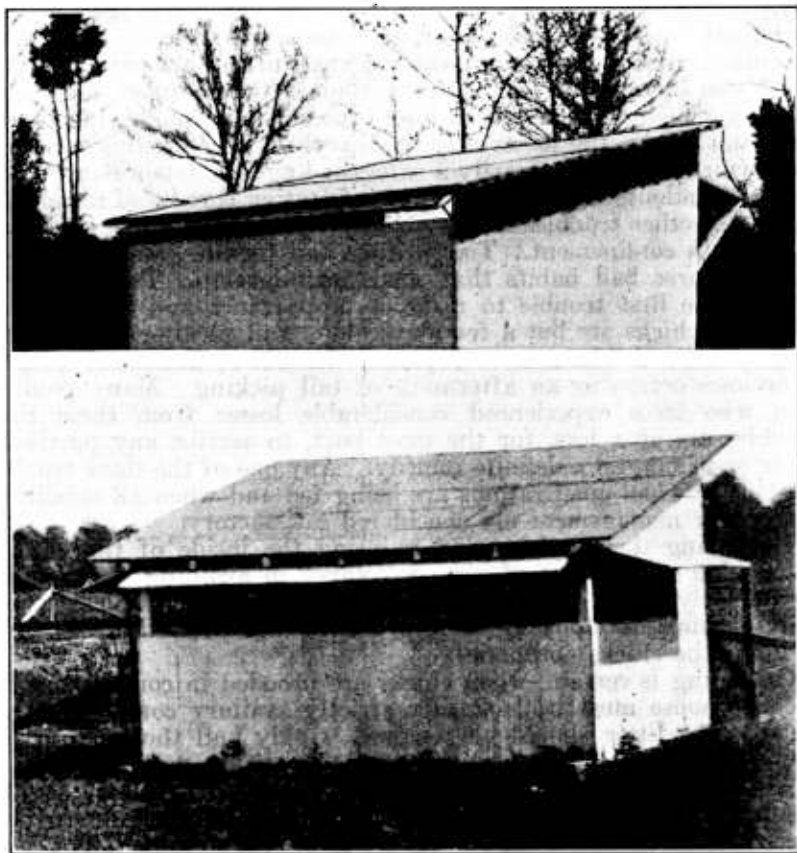


FIG. 12.—Methods of ventilating chick-rearing houses during the summer months. Ventilator under eaves at back of house (*above*). Sides and rear of the house opened to provide adequate ventilation in summer (*below*). (Adapted for southern areas)

nated soil are factors that frequently cause high mortality in chicks. Safeguarding against all these conditions will insure success.

#### CARE OF CHICKS AFTER THE BROODING SEASON

In order that the growth of the chicks may proceed normally after the brooding season, which is understood to mean from hatching time until no artificial heat is required, certain practices should be followed. Many farmers and poultrymen do not realize that as the chicks grow they need more houseroom. A brooder house large enough to accommodate about 350 chicks during the brooding season

is too small for that number when they are about 10 or 12 weeks old. At this age the chicks should be well feathered, and most of them should have learned to roost. Unless they are given more houseroom they are liable to get overheated on warm nights.

One good way of providing more room is to separate the sexes. This avoids the possibility of the cockerels annoying the pullets, and is especially desirable in order to allow the pullets to mature properly. Moreover, the cockerels may be sold as broilers or fryers early in the season or may be reared by themselves and sold as roasters in the fall of the year.

During the summer months the houses should be well ventilated. This can be done by removing the windows in the front of the house and opening those on the sides and in the rear, or if there are no windows in the rear of the house, keeping the rear ventilating door open. (Fig. 12.)



FIG. 13.—The brooders have been removed from the houses, and the houses have been hauled to one of the farm fields where the growing chicks have access to abundant range in the cornfield and thus have clean land and plenty of shade while the corn is growing

While good range on clean land where grass or other succulent green feed is growing is necessary, abundance of shade should be provided. If there are no trees or bushes in the field where the chicks are being raised and if they have no access to a tall growing crop, such as corn (fig. 13), then shade can be provided very readily by nailing boards on a frame which is nailed to four stakes driven into the ground.

The chicks should be culled from time to time throughout the growing season. Weak chicks should be removed as they appear because they rarely develop into profitable birds. Diseased chicks should be removed at once and burned or buried; otherwise the healthy chicks may become contaminated. The houses and the land should be kept in sanitary condition at all times, since it is the best insurance against ill health and promotes the best growth. The care and attention given the chicks throughout the entire growing season determines in large measure the profits realized from the birds marketed and those kept for egg production.

# ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

November 21, 1927

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